CLAIMS

I claim:

1. A method to seal a porous dielectric comprising:

exposing the porous dielectric material that comprises reactive groups adjacent a surface of the material to a coupling agent; and

wherein the coupling agent reacts with the porous dielectric material to form coupling structures linked to the dielectric material.

2. The method of claim 1 wherein a coupling structure comprises a cap that seals the porous dielectric.

3. The method of claim 2 wherein the coupling agent comprises acetyl chloride.

4. The method of claim 1 wherein coupling structures comprise crosslinking groups that react to form crosslinks between coupling structures to seal the porous dielectric.

5. The method of claim 4 wherein the coupling agent comprises at least one of succinyl chloride and phosgene.

6. The method of claim 4 wherein the crosslinked coupling structures comprise a barrier to prevent external materials from penetrating pores in the porous dielectric material.

7. The method of claim 1 further comprising exposing the coupling structures to a sealing agent.

8. The method of claim 7 wherein the sealing agent comprises a crosslinking agent.

9. The method of claim 8 wherein the coupling agent comprises phosgene and the crosslinking agent comprises a multifunctional alcohol.

10. The method of claim 7 wherein the sealing agent comprises a capping agent.

11. The method of claim 10 wherein the coupling agent comprises phosgene and the capping agent comprises a monofunctional alcohol.

12. A method to seal a pore in a dielectric material structure comprising:

introducing a silane coupling reagent comprising a thiol end cap and at least one alkoxy side group reactive to SiOH at the surface of a pore; and

introducing an oxidizing agent to facilitate formation of disulfide bonds between adjacent oxidized thiol end caps.

13. The method of claim 12 wherein the silane coupling agent comprises a silicon atom, and wherein the thiol end cap is coupled to the silicon atom by a substantially long chain of CH_2 molecules.

14. The method of claim 13 wherein the thiol end cap is coupled to the silicon atom by about 4 CH_2 molecules.

15. The method of claim 12 wherein the at least one alkoxy side group is selected from the group consisting of OCH3, O-ethyl, O-methyl, O-tertbutyl, and O-isopropyl.

16. The method of claim 14 wherein the silane coupling reagent comprises three OCH_3 side groups.

17. The method of claim 12 wherein the oxidizing agent comprises formaldehyde.

18. A device comprising:

a substrate layer;

a porous dielectric layer adjacent the substrate layer with a an exposed pore having an opening; and

a barrier across the opening of the exposed pore.

19. The device of claim 18 wherein the barrier comprises a first barrier molecule with:

a silicon atom coupled to a surface of the pore;

a sulfur atom; and

a flexible chain between the silicon atom and the sulfur atom.

20. The device of claim 19 wherein the flexible chain comprises a substantially long chain of CH_2 molecules.

21. The device of claim 20 wherein the substantially long chain of CH_2 molecules comprises four CH_2 molecules.

22. The device of claim 18 wherein the barrier further comprises a second barrier molecule with:

a silicon atom coupled to a surface of the pore;

a sulfur atom; and

a flexible chain between the silicon atom and the sulfur atom.

23. The device of claim 22 wherein a disulfide bond connects the sulfur atom of the first barrier molecule with the sulfur atom of the second barrier molecule.

24. The device of claim 18 wherein the exposed pore is in a range from about 20 angstroms to about 100 angstroms, and the barrier comprises about 6 to about 30 crosslinked barrier molecules.

25. A method to seal an exposed pore in a dielectric material comprising:

exposing the exposed pore to a coupling agent;

forming links coupling the coupling agent to a surface of the pore;

exposing the exposed pore and the coupling agent to an oxidizing agent; and

forming a barrier across the pore.

26. The method of claim 25 wherein the coupling agent comprises barrier molecules with:

a silicon atom;

an end cap;

a flexible chain between the silicon atom and the end cap; and

a surface coupling group.

27. The method of claim 26 wherein forming a barrier across the pore comprises forming a disulfide bond between a sulfur atom in the end cap of a first barrier molecule and a sulfur atom in the end cap of a second barrier molecule.

28. The method of claim 26 wherein the flexible chain comprises a substantially long chain of CH_2 molecules.

29. The method of claim 28 wherein the substantially long chain of CH_2 molecules comprises four CH_2 molecules.

30. The method of claim 26 wherein the surface coupling group comprises an OCH_3 group.

31. The method of claim 25 wherein the oxidizing agent comprises formaldehyde.